NO_x Reduction by Fuel-Lean Biomass Reburning

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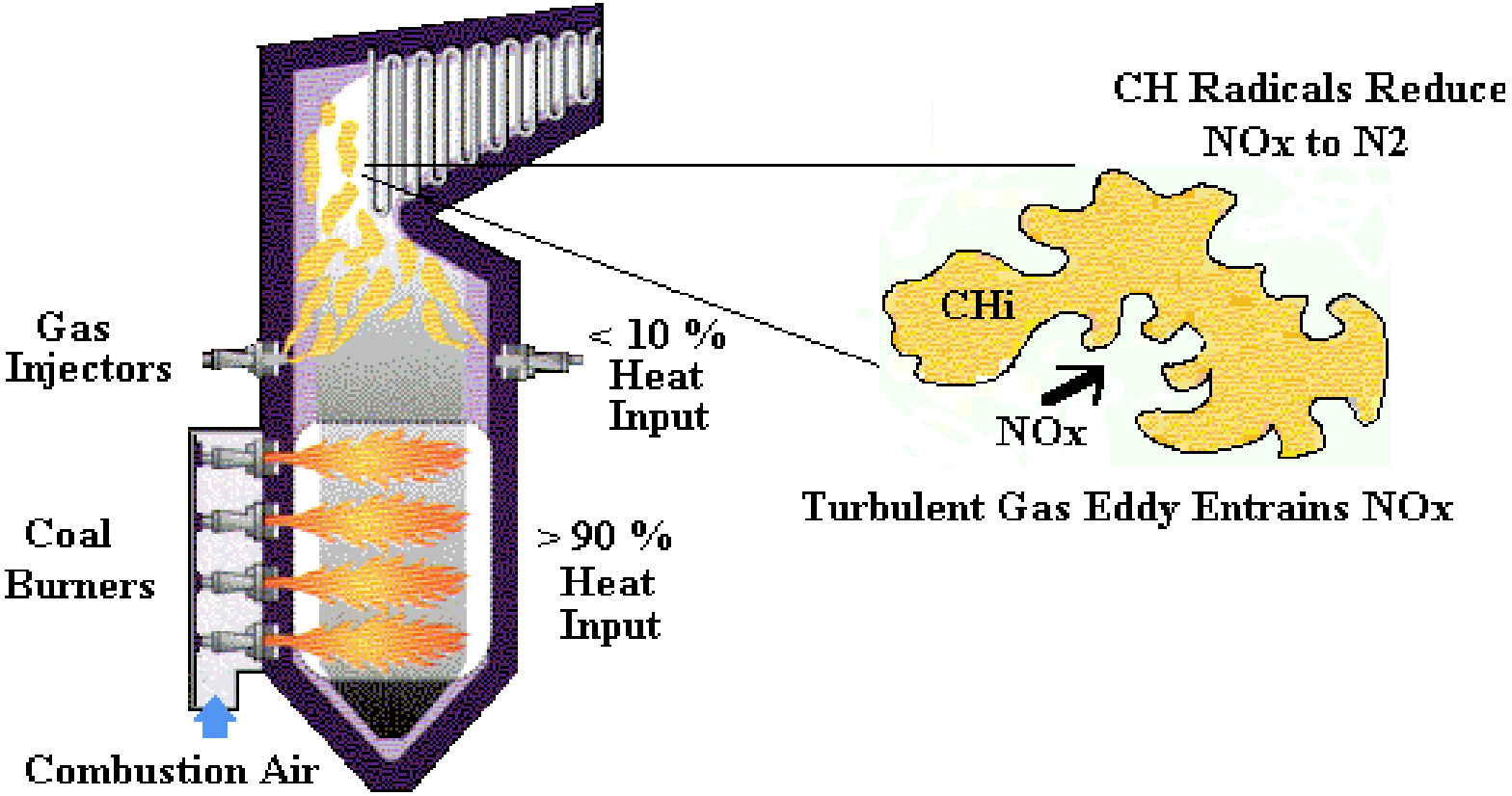
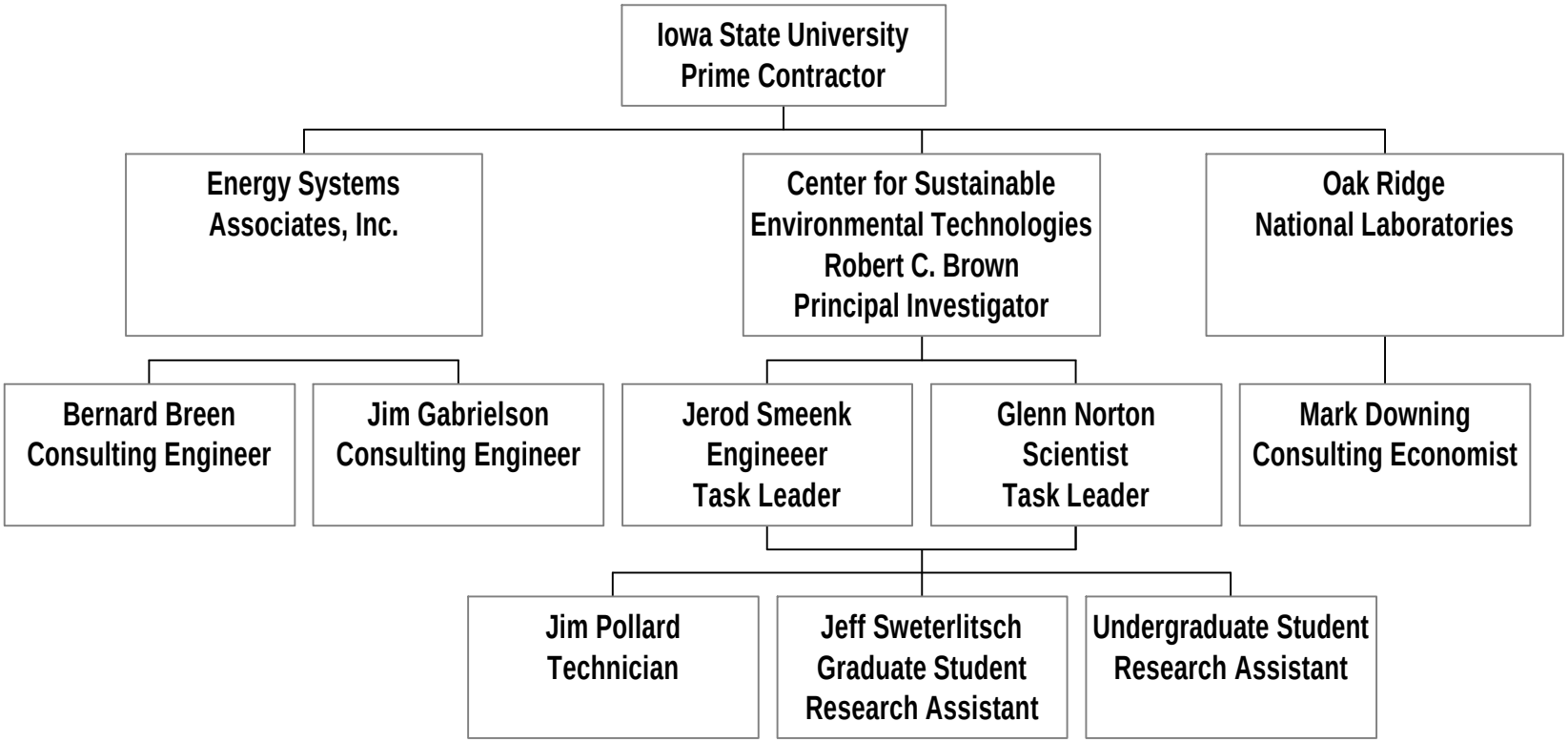
Fuel-Lean Gas Reburning



Fuel-Lean Biomass Reburn Project Team



Tasks To Be Performed

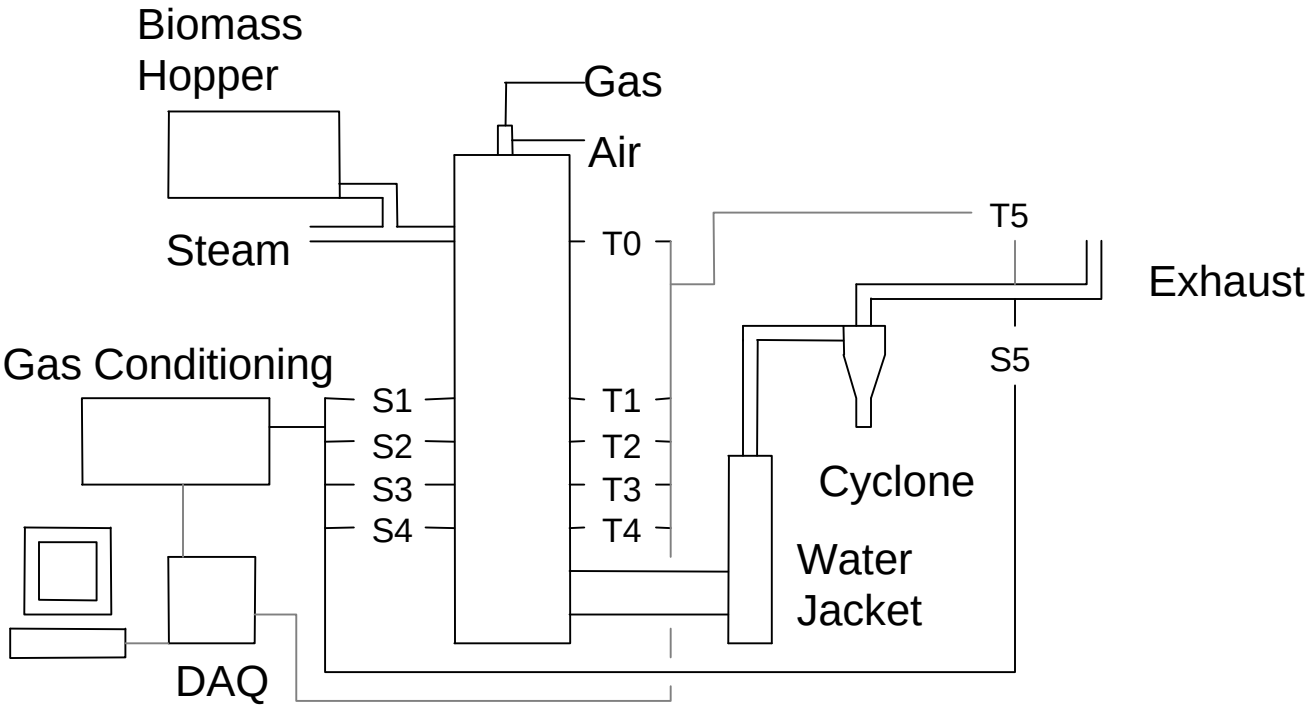
- Task 1 – Prepare combustor for biomass reburn fuels.
- Task 2 – Instrumentation support for project.
- Task 3 – Prepare biomass feedstocks.
- Task 4 – Cofire biomass to simulate Fuel-Lean Biomass Reburn in PC/CFB boilers.
- Task 5 – Cofire biomass to simulate Fuel-Lean Biomass Reburn in stoker boilers.
- Task 6 – Final report.

Tasks in Progress/Completed

Task 1 – Prepare combustor for biomass reburn fuels

- Combustor modified from a previous experimental arrangement to accommodate a longer residence time.
- Cyclone added to the exhaust line.
- A fifth gas sampling port was installed downstream to measure the gas stream at a lower temperature and longer residence time.
- Support structure for the biomass hopper is nearly completed. A steam line will be installed afterwards.

Schematic of Experimental Apparatus



T# : Temperature Location
S# : Gas Sample Location

Experimental Apparatus

Down Flow Combustor

Experimental Apparatus

<u>Primary combustion zone</u>

- Natural gas burner
  - Natural gas mixed with NH_3 to simulate coal combustion.

Experimental Apparatus

Reburning Zone

Biomass injection port

Experimental Apparatus

Reburning Zone

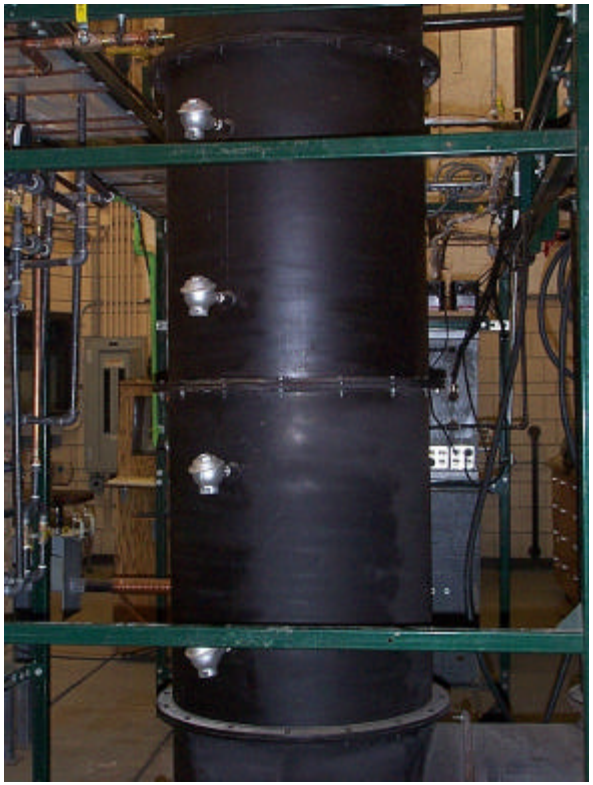
Gas sampling ports

(S1 – S4)

Experimental Apparatus

Reburning Zone

- Type – R Thermocouples (T1 – T4)



Experimental Apparatus

- Exhaust
  - Cyclone separator
  - Gas sampling port (S5)
  - Type-K thermocouple (T5)

Experimental Apparatus

- Control Panel
  - Air, gas, and ammonia flowrates controlled with rotameters and measured with differential pressure flowmeters.
  - On/Off switch and automatic burner control.
  - Water flowrate for water jacket controlled with rotameter.

Tasks in Progress/Completed

Task 2 – Instrumentation support for project.

- A new $NO/NO_2/NO_x$ chemiluminescence analyzer was purchased.
- A new CO/CO_2 infrared analyzer was purchased.
- New data acquisition instrumentation was purchased.
- Installation and configuration of the above instrumentation will begin in the next few weeks.

Tasks in Progress/Completed

Task 3 – Prepare biomass feedstocks

- Ground switchgrass prepared with a tub-grinder
- Switchgrass-water slurries were prepared
  - 50:50 (wt%) slurry: “damp switchgrass”
  - 15:85 (wt%) slurry: pumpable but thought to be too wet to burn
- Turning focus toward steam-entrained chopped herbaceous fuels (switchgrass and alfalfa)